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VS

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John A. Kitzhaber, MD, Governor

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January 29, 2014

Also Sent Via E-mail

Mr. Robert J. Wyatt
NW Natural
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Re: Data Report, Source Control Extraction System Test - Shoreline Segments 1 and 2, NW Natural Property and the Northern Portion of the Siltronic Corporation Property
Portland, Oregon
ECSI Nos. 84 and 183

Dear Mr. Wyatt:

The Department of Environmental Quality (DEQ) reviewed the "Data Report: Groundwater Source Control Extraction System Test – NW Natural Gasco Site" dated December 23, 2013 (Test Summary Report). The Test Summary Report presents the results of the Phase 1-Step 1, Step 2, and Step 3 tests of the Alluvium water-bearing zone (WBZ) hydraulic control and containment (HC&C) system. Anchor QEA, LLC (Anchor) prepared the Test Summary Report for NW Natural.

The primary purpose of this letter is to inform NW Natural that DEQ approves Anchor's recommendations to:

- Reduce the frequency of water level measurements from 1-minute to 15-minutes at the installations where the higher data collection rate is being used; and
- Perform a set-point test (i.e., Phase 1-Step 4) that involves pumping all extraction wells in the HC&C system for 7-days at a set-point of -0.3-feet.

In an e-mail dated January 8, 2014, DEQ previously provided written approval of Anchor's recommendation to redevelop extraction wells PW-1L and PW-1U before initiating the Step 4 test.

In addition to DEQ, the U.S. Environmental Protection Agency (EPA) reviewed the Test Summary Report. The DEQ and EPA comment sets are attached as Attachment 1 and Attachment 2 respectively. For clarification, DEQ and EPA are not requesting the Test Summary Report to be revised and resubmitted. Our comments are intended to be addressed by the next HC&C system test data report (e.g., the data report for the Phase 1-Step 4 test).

Please contact me with questions regarding the attachments.

Sincerely,

Dana Bayuk
Project Manager
Northwest Region Cleanup Section

Attachments: DEQ Comments
EPA Comments

Cc: Myron Burr, Siltronic Corporation
Patty Dost, Pearl Legal Group
Alan Gladstone, Davis Rothwell Earle and Xochihua
John Edwards, Anchor
Ben Hung, Anchor
John Renda, Anchor
Rob Ede, Hahn & Associates
Lance Downs, Advanced Remediation Technologies, Inc.
Terry Driscoll, Aponowhich, Driscoll & Associates
Mike Crystal, Sevenson Environmental Services, Inc.
James Peale, Maul Foster Alongi
Sean Sheldrake, EPA
Rich Muza, EPA
Lance Peterson, CDM Smith
Scott Coffey, CDM Smith
Keith Johnson, NWR/Cleanup Section
Tom Gainer, NWR/Cleanup Section
Henning Larsen, NWR/Cleanup & Tanks Section
Rob Burkhart, NWR/Water Quality Section
ECSI No. 84 File
ECSI No. 183 File

ATTACHMENT 1

DEQ Comments
"Data Report: Groundwater Source Control Extraction System Test
NW Natural Gasco Site"
Portland, Oregon

Dated December 23, 2013

DEQ reviewed the "Data Report: Groundwater Source Control Extraction System Test – NW Natural Gasco Site" dated December 23, 2013 (Test Summary Report). The Test Summary Report presents the results of the Phase 1-Step 1, Step 2, and Step 3 tests of the Alluvium water-bearing zone (WBZ) hydraulic control and containment (HC&C) system. Anchor QEA, LLC prepared the Test Summary Report for NW Natural.

Consistent with Final Test Plan[1], the HC&C system Phase 1 tests completed to date and documented in the Test Summary Report include the following:

- Phase 1-Step 1 – Pump the upper tier of extraction wells located in the portion of shoreline Segment 1 where DNAPL occurs for 24-hours at a set-point of -0.10-feet
- Phase 1-Step 2 – Pump all extraction wells in the HC&C system for 7-days at a set-point of -0.10-feet
- Phase 1-Step 3 – Pump all extraction wells in the HC&C system for 7-days at a set-point of -0.15-feet

Water levels were allowed to recover subsequent to completing steps 1 and 2 (i.e., prior to initiating steps 2 and 3).

DEQ's comments on the Test Summary Report are provided below. DEQ requests that NW Natural address the comments in the next HC&C system test data submittal (e.g., the Phase 1-Step 4 test report).

GENERAL COMMENT

Data Evaluations, Report Organization, and Data Collection Objectives

The HC&C system is being tested in two phases that are described in Section 3 of the Final Test Plan. A primary objective of the 1st phase of testing is to select the set-point for the long-term testing phase (i.e., Phase 2). Selection of the set-point for Phase 2 is dependent on the Phase 1 set-point tests achieving data collection objectives 1 through 6 listed in Section 2.2 of the Final Test Plan. The Test Summary Report compiles water level data recorded during the first 3 steps of Phase 1 testing onto figures that allow the results to be evaluated in terms of the data collection objectives. However, the Test Summary Report does not evaluate and/or discuss the data in the context of the data collection objectives. DEQ acknowledges that the first phase of HC&C system is ongoing and NW Natural is recommending further Phase 1 testing. That said,

[1] Anchor QEA, LLC, 2013, "Final Groundwater Source Control Extraction System Test Plan – NW Natural Gasco Site," November (received November 13, 2013), a document prepared for NW Natural.

the basis for moving forward with the long-term Phase 2 test will be a detailed and thorough demonstration of how the data collection objectives have been met by the Phase 1 set-point tests. DEQ anticipates this evaluation will be provided in the submittal that NW Natural believes achieves these objectives.

Although individual figures in the Test Summary Report compile data in a usable format for evaluating HC&C testing, the current organization of the document does not lend itself to evaluation in terms of the data collection objectives. In general, water level data in the Test Summary Report are organized and presented according to hydrostratigraphic unit and location. Based on DEQ's review, it appears the discussions and data presentations focus on differences in water level elevations between different hydrostratigraphic units and the river and between adjacent hydrostratigraphic units. However, the data collection objectives are based on comparisons of water level elevations between the river and installations in the performance monitoring network based on the design objective (upper Alluvium WBZ installations in the portion of Segment 1 where DNAPL occurs); the installation type (control wells); the hydraulic efficiency of the material in which installations are constructed (minimal, low, or high); and the locations of installations (e.g., installations at the margins of the network, installations in the deep lower Alluvium WBZ). DEQ requests the next test data summary report organize discussions and data presentations according to data collection objectives.

SPECIFIC COMMENTS

1. The Test Summary Report compares groundwater elevations to river stage for installations completed in different hydrostratigraphic units (e.g., Fill WBZ, Upper Alluvium WBZ). DEQ notes that each shallow in-water piezometer is referred to as being a "Fill Well." DEQ recommends that the word "well" be removed from the titles of the figure 4-series, 5-series, 7-series figures and Figure A.1 to avoid potential misunderstandings or confusion regarding the purpose of an installation. For example, the title for Figure 4.12 would be revised to "Fill (PZ7-5) and River." Revising the title of figures 7.5a and A.1 to "Lower Alluvium (PZ6-115) and Deep Lower Alluvium (PZ6-150)" and "All Fill Installations" are respectively other examples.
2. Figures in the Test Summary Report indicate that many of the installations constructed in the deep lower Alluvium WBZ consistently exhibit water level elevations above the river (i.e., MW-21-165, MW-18-180, PZ6-150, MW-19-180, PZ7-150, MW-5-175)). DEQ understands that pending the outcome of the Phase 1-Step 4 set-point test NW Natural may be using a gradient analysis approach to assess the influence of the HC&C system on these installations. The analysis involves calculating and comparing the hydraulic gradient between the installation and river and the installation and the nearest extraction well. NW Natural and DEQ agree that groundwater in the deep lower Alluvium WBZ will move in the direction of the higher gradient. Details regarding how the gradient analyses will be performed have not been provided to date. DEQ requests that the analyses be fully documented in the first submittal where the approach is used. Documentation should include cross-sections showing the flow paths used in each of the gradient calculations performed. For clarification, discussions of vertical flow paths in Section 3.3 of the report do not meet the needs of the project. Comparison of water level differences between paired wells provides information on

the potential relative movement of groundwater between hydrostratigraphic units. The water level comparisons alone do not provide information on groundwater flow path(s).

3. As indicated in Comment #2, many deep lower Alluvium WBZ installations consistently exhibit water level elevations above the river. That said, there are monitoring wells constructed in the deep lower Alluvium WBZ whose water level elevations are approximately equal to or lower than the river (WS-14-161, WS-11-161, WS-12-161). DEQ believes well construction may influence the water levels being recording in at least two cases. As indicated by Figure 2-3c, the screened intervals for monitoring wells WS-14-161 and WS-11-161 penetrate the deep aquitard. Penetration of the deep aquitard could hydraulically connect the lower Alluvium WBZ with the deep lower Alluvium WBZ and result in an apparent influence on these installations by the HC&C system that would not occur otherwise. This scenario should be evaluated further during the Phase 1, Step 4 test. Regarding WS-14-161, due to the appearance of DNAPL in this well Siltronic is preparing an abandonment plan that will be submitted to DEQ on or before February 14, 2014.
4. The method used to compare water levels in the figure 5-series appears to be inconsistent. Comparisons are sometimes based on subtracting the water level elevations recorded in a shallow installation from a nearby deeper installation (e.g., Figure 5.1). In other cases, the water level elevations recorded in a deeper installation are subtracted from the shallower (e.g., Figure 5.4). To avoid confusion, DEQ requests that all such water level comparisons be made using a consistent approach. DEQ notes that subtracting the shallow water level from the deeper supports the convention of using a positive value to represent upward vertical gradients and a negative value for downward.
5. As indicated in the cover letter, DEQ approved redevelopment of extraction wells PW-1U and PW-1L prior to conducting the Phase 1-Step 4 test. DEQ requests that documentation of redevelopment be included in the next data summary report. Consistent with previous work done by NW Natural, documentation should include an evaluation of whether redevelopment achieved the desired objective of improving the capacity of each well.
6. DEQ requests that the figure 3-series and the figure 6-series in next test data summary report include respectively, equipotential contour maps and water-level difference contour maps for the deep lower Alluvium WBZ.
7. DEQ notes that geologic cross-section F-F' (Figure 2.8b) has not been revised to show DNAPL occurrence at elevation -25-feet at the GS-09 location as indicated in our August 9, 2012 comments letter (see DEQ's "Category 1, Comment 13, Section 2.1.4, 2nd paragraph" comment). To date, the information DEQ requested to support NW Natural's conclusion that DNAPL is not present in GS-09 at elevation -25-feet has not been provided. Until the supporting information is submitted and accepted by DEQ, the referenced occurrence of DNAPL should be shown on the cross-section.

ATTACHMENT 2

EPA Comments on Data Report: Groundwater Source Control Extraction System Test, NW Natural GASCO Site, Portland, Oregon Dated December 23, 2013

The following are U.S Environmental Protection Agency (EPA) comments on the document titled *Data Report: Groundwater Source Control Extraction System Test* dated December 23, 2013 and prepared by Anchor QEA, LLC for NW Natural.

The EPA notes that the Introduction states "This Data Summary report was not intended to be an analysis of whether the HC&C system achieved hydraulic capture of groundwater." Nevertheless, the document does present general conclusions regarding whether a gradient reversal was attained throughout Segments 1 and 2 in the four main designated hydrostratigraphic units: Fill, Upper Alluvium, Lower Alluvium and Deep Alluvium during the Phase 1 step tests (1 through 3).

The EPA evaluated this document based on whether the data presentation meets the stated requirements and objectives in the *Revised Groundwater Source Control Extraction System Test Plan (NW Natural, October, 2013)*. In addition, the EPA evaluated the presentation of data and whether it clearly portrays the test results, or if improvements to the presentation could be made in future documents.

General Comments

EPA has the following general comments related to this document.

1. In general, the report text is unclear in its explanation of findings and is missing discussion of how specific evaluation concepts for performance objectives (e.g. vertical capture of deep alluvium groundwater) are demonstrated and proven in the data summary/analysis graphics. These issues are found throughout the text and are pointed out in Specific Comments below; a few examples are provided as follows:

    a. It is unclear why some wells are singled out for specific mention when other analysis graphics of other wells appear to show similar attributes (e.g. no influence to pumping, or downward gradient). For example, MW-16-45 is noted in Section 3.2 as having no apparent response to pumping, but other monitoring wells also show no apparent response to pumping. No explanation is given for these wells, or why the special mention for MW-16-45 over the other wells that do not show apparent response to pumping (e.g. fill wells, MW-22U, MW-23U, PZ1-20, PZ2-20, PZ-5-20, MW-21U, PZ-4-12, WS-26-86, WS-8-59). Further, there are wells very close to, or within

the bounds of measurable uncertainty. A specific list of these wells should be provided.

b. Monitoring wells mentioned in the text should have a figure number referenced to it. For example, the reference to MW-16-45 in Section 3.2 should indicate what figure number this statement/evaluation pertains to. This also is missing in Section 3.3, where charts are introduced for the various hydrogeologic units, but there are no references to the figures. These should be added in future data summary report text.

c. The switching of what negative and positive mean over the various comparisons between the hydrostratigraphic layers, (such as the analysis in Section 3.3) is inconsistent with other sections and confusing. The subtraction of layers should be consistent, so that negative will consistently indicate one direction of gradient and a positive will consistently indicate the opposite gradient direction.

2. Future data summary and/or capture analysis reports should include a summary table that presents the seven objectives of data collection and provides summary statistics on the number or wells, or well pairs that meet the objective out of the number of wells, or well pairs that were used to evaluate that specific objective. Further detail, such as a list of the wells, or wells pairs not meeting, or within the bounds of uncertainty for a specific objective should be provided. This gives a clear overall assessment where objectives were met and where specific improvements to the system are needed in order to meet objectives.

Specific Comments

EPA has the following specific comments related to this document.

1. Section 2, Page 4, last sentence: The text should insert the word "relative" between "estimate" and "hydraulic efficiency" to be consistent with Table 2.

2. Section 3.1: Similar to what is shown for the analysis in Section 3.3, NW Natural should show maps with contours of water level difference between the four hydrostratigraphic zones and the river down to the limits of measurable certainty (0.05 feet). These maps would be easier to interpret than the potentiometric surface maps to discern where gradient reversals were and were not achieved throughout the selected 3-day rolling average test periods.

3. Section 3.2: This section is missing a description and explanation of some key patterns seen in the water level difference hydrographs including:

a. An explanation on the meaning and significance of water level difference graphs trending upward throughout the hydraulic test period.

b. An explanation of wells that have water level differences changing from positive to negative, or to less positive relationships with the river stage.

c. A highlight or list of wells that fall within the bounds of potential measurement uncertainty for verifying gradient reversal.

4. Section 3.2, Page 6, last paragraph: The mention of monitoring well MW-16-45, should include a reference to the relevant figure and an explanation given as to why this well is called out specifically, when other wells also appear to have no apparent response to pumping (see General Comment 1, subpart a).

5. Section 3.3.1, Page 7, first paragraph: The rationale for switching what negative means for the water level difference graphs for the compared hydrostratigraphic layers presented for this section is unexplained and confusing (see General Comment 1, subpart c for suggested revision).

6. Section 3.3.1, Page 7: As pointed out in Specific Comment 1, part c, wells that show inconclusive evidence for gradient control by the hydraulic control system (e.g. wells within the 0.05 ft. confidence bounds) should be presented in a list. This would be a separate list pertaining to the evaluation relevant to this section (Section 3.3.1) and associated figures (Figures 5.1 through 5.21).

7. Section 3.3.1, Page 7, last paragraph: The reference to Figure 5.8 in the list of figures showing Segment 1 water level comparison graphs is incorrect. Figure 5.8 shows PZ-4, which is a Segment 2 well according to the location map (Figure 1.1).

8. Section 3.3.2, Page 8: NW Natural should include water level difference maps for the fill and Deep Alluvium layers, or explain why they were not prepared.

9. Section 3.3.2, Page 8: NW Natural should explain how the downward gradient between the upper and lower alluvium in Segment 2 and an upward gradient between the same layers in adjacent Segment 1 interact horizontally. The current text seems focused on vertical gradient relationships for individual wells within the individual segments. The analysis should incorporate horizontal flow and the influence across segments with the downward movement of groundwater in Segment 2 and the Siltronic property in relation to the upward movement of groundwater in Segment 1.

10. Section 3.3.3, Pages 8-9: NW Natural's inclusion of upper and lower alluvium well water level comparisons is unclear in this analysis. The EPA understood that it was important to demonstrate upward vertical flow paths from the deep alluvium to the upper or lower alluvium layers where the pumping wells

are placed. This data presentation would also demonstrate that the upward vertical flow is directed toward the pumping wells in the upper/lower alluvium layers. The graphs provided for this section (Figures 7.1-7.8b) do not meet EPA expectations for clear demonstration of this capture. Some graphs only show water level differences between Upper and Lower Alluvium wells in relation to the river, which seems irrelevant when the objective of this section is to demonstrate flow from the deep alluvium into the upper/lower alluvium strata where pumping occurs. NW Natural should consider providing a cross-section cut-out of the wells being assessed and show the calculated max, min, and average water level differences shown in Figures 7.1 – 7.8b at each monitoring well screen interval, similar to what was shown in the *Segment 2 Field Tests of the Programmable Logic Control and Variable Frequency Drive Well Pumps* document dated May 2011.

11. Section 3.3.3, Page 8, first paragraph, last sentence: The last sentence of this paragraph states "Negative water level elevation differences indicate upward flow between WBZs, or from the river to the Lower/Deep Alluvium WBZ wells" The last part of this sentence is confusing and seemingly wrong. For instance, it is not clear how a negative water elevation difference indicates upward flow from the river to a hydrostratigraphic layer. NW Natural should clarify, or revise this text.

12. Section 5, Page 12: EPA understands the Oregon Department of Environmental Quality has authorized NW Natural to undertake the additional screen development at PW-1U and PW-1L. EPA believes it would be valuable for NW Natural to have provided more information to explain why they believe additional screen development will address the well yield problem. For example, NW Natural should include calculations comparing specific capacities of these wells derived during the Phase 1 step tests 2 and 3 with previous end-of-development specific capacities and specific capacities estimated for the water bearing zone. If there are no differences, it would appear that well losses have not occurred over the time period between last development and testing, so this contingency measure may be unproductive. Furthermore, NW Natural should present the specific capacity information to demonstrate how much additional yield could be gained by lowering the pumps and confirm that the wells will maintain a 0.3 ft. set point goal proposed for Step 4.

13. Section 6, Pages 13-15: The comments presented above are relevant to the conclusions and recommendations presented in this section and will not be repeated here.

14. Figures 3.1a through 3.3b: These figures should be supplemented with contours of water level difference between river stage and well water level based on Serfes Averages for two periods during the step 3 test for the fill, upper and lower alluvium layers.

15. Figures 3.1a through 3.3b and Figures 6.1 through 6.3: A description of how the contour lines are generated should be provided in the legend. For example, clarify whether the contours were generated by Inverse Distance Weighted, a Kriging process using a statistical interpolation software package, or were drawn manually, etc.

16. Water Level Difference Figures 4.1 through 4.79 and 5.1 through 5.21: The total potential uncertainty of -0.05 feet, denoted on each water level elevation difference graph, should also be shown for the positive side (+0.05) since the limits of measurement would also apply to wells showing positive difference in water level elevations.